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U S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY 'S DOCKET NUMBER
108041-0004

U.S. APPLICATION NO. (If known, see 37 CFR 1.5
10/018965

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/IB00/00097	22 August 2000	28 June 1999

TITLE OF INVENTION
METHOD FOR MANAGING ENERGY CONSUMPTION OF HOSUEHOLD APPLIANCES

APPLICANT(S) FOR DO/EO/US
MELONI, FRANCESCO

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☒ is attached hereto (required only if not communicated by the International Bureau).
   b. ☐ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☒ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English lanugage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
14. ☐ A SECOND or SUBSEQUENT preliminary amendment.
15. ☐ A substitute specification.
16. ☒ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☒ Other items or information:
    - x International Preliminary Examination Report
    - x International Search Report
    - x Response to Written Opinion

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U.S. APPLICATION NO (if known, see 37 CFR 1.5) 10/018965	INTERNATIONAL APPLICATION NO PCT/IB00/00097	ATTORNEY'S DOCKET NUMBER 108041-00004

21. ☐ The following fees are submitted:	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1040.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$890.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$740.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$710.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 890.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☒ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$ 130.00	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	$	
Total claims	57 - 20 =	37	x **$18.00**	$ 666.00	
Independent claims	5 - 3 =	2	x **$84.00**	$ 168.00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$280.00**	$	
TOTAL OF ABOVE CALCULATIONS =				$	
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2. +				$	
SUBTOTAL =				$	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				$	
TOTAL NATIONAL FEE =				$	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$ 40.00	
TOTAL FEES ENCLOSED =				$ 1894.00	
				Amount to be refunded:	$
				charged:	$

a. ☒ A check in the amount of $ 1894.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. ____________ in the amount of $ __________ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 03-1237. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

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REGISTRATION NUMBER

10018965 . 121801

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In Re The Application of:
Francesca Meloni

Serial No.: not yet assigned

Filed: December 18, 2001

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For: METHOD FOR MANAGING ENERGY CONSUMPTION OF HOUSEHOLD APPLIANCES

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December 18, 2001

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Honorable Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

PRELIMINARY AMENDMENT

Please cancel claims 1-32 and add the following new claims 33-89 as set forth below:

In the claims:

33. A system for managing electric power consumption of electric users, the system in-

cluding:

A. a set of smart users with each user equipped with a control system, the set of smart users being operatively connected to communicate over a network;

B. a power meter for transmitting information relating to power consumption to the set of smart users over the network;

C. the control system of a given smart user determining an associated effective priority that is used to control power consumption of the given user relative to the set of users, the control system determining the effective priority on the basis of

i. the information transmitted by the power meter, and

ii. the current operating state of the given smart user.

34. The system for managing electric power consumption, according to claim 33, wherein the control system of a given smart user establishes the right of the given user to consume a level of available power based on the associated effective priority.

35. The system for managing electric power consumption, according to claim 34, wherein the control systems employ the effective priorities of the respective smart users as starting values in a competition among the smart users for consumption levels of available power.

36. The system for managing electric power consumption, according to claim 35, wherein the effective priority associated with a given smart user varies over time in accordance with the operating state of the given smart user.

37. The system for managing electric power consumption, according to claim 36,

wherein the operating states of the given smart user are associated respectively with dynamic priority values, and the control system uses the dynamic priority values to determined the effective priorities.

38. The system for managing electric power consumption, according to claim 37, wherein the effective priority value controls a priority timer that sets the times to determine a next effective priority value.

39. The system of managing electric power consumption, according to claim 37, wherein the control system of a given user operates in a competition for increment state in which the user reduces energy consumption when the information transmitted by the power meter indicates that power consumption is above a predetermined value.

40. The system of managing electric power consumption, according to claim 38, wherein in a competition for increment state, the control system

i. evaluates the power consumption information at a time determined by the timer and

ii. transitions to a next operating state.

41. The system of managing electric power consumption, according to claim 40, wherein the control system determines to which state to transition based also on various power threshold values stored in the control system.

42. The system of managing electric power consumption, according to claim 41, wherein the power threshold values are adjustable.

43. The system of managing electric power consumption, according to claim 42, wherein the power threshold values are adjusted individually for each smart user.

44. The system of managing electric power consumption, according to claim 40, wherein certain state transitions include taking one or more packets of available power.

45. The system of managing electric power consumption, according to claim 40, wherein certain transitions are to a quiescent state in which minimum power is consumed.

46. The system of managing electric power consumption, according to claim 45, wherein in the quiescent state the control system resets the effective priority to a predetermined minimum value and subsequently increments the effective priority at times determined by the timer.

47. The system of managing electric power consumption, according to claim 34, wherein power consumption of a smart user is reduced through a deactivation step in a decrement routine.

48. The system of managing electric power consumption, according to claim 41, wherein the control system, in response to power consumption above a predetermined lower threshold and below a predetermined higher threshold, operates in a competition for decrement state to reduce energy consumption.

49. The system of managing electric power consumption, according to claim 47, wherein

during a transition from the competition for decrement state the control system updates the effective priority in a direction that is the opposite of the power consumption associated with the state to which the control system transitions.

50. The system of managing electric power consumption, according to claim 47, wherein in the competition for decrement state the control system of a given smart user executes a transition to a state in which a power packet is released.

51. The system of managing electric power consumption, according to claim 37, wherein, in line with information about available power exceeding a predetermined threshold, the smart users having effective priorities below a fixed threshold are deactivated.

52. The system of managing electric power consumption, according to claim 37, wherein, in line with information about available power above a predetermined power threshold, the smart users with effective priorities below a predetermined priority threshold are activated.

53. The system of managing electric power consumption, according to claim 34, wherein the control system of a given smart user operates under an associated reduced load strategy and/or reduced consumption strategy that are included in increment and decrement routines.

54. The system of managing electric power consumption, according claim 35, wherein the effective priority values are based on associated dynamic priority values and the

smart users respectively have dynamic priority values that differ from the values of each other smart user.

55. The system of managing electric power consumption, according to claim 12, wherein a given smart user draws a power packet in a different instant than do other smart users that are drawing power packets.

56. A method for managing electric power consumption including the steps of

A. setting at each smart user, based on the operating state of the smart user, an associated effective priority for access to energy consumption levels;

B. initialising a timer to a count that is proportional to the effective priority;

C. when the timer count expires, providing the associated smart user with access to available energy; and

D. repeating steps A-C.

57. The method for managing electric power consumption, according to claim 56, wherein the timer is a counter that employs a larger number of bits than the number of bits included in the effective priority value, and the step of initialising the timer includes using the effective priority value as part of the starting count.

58. A method for managing electric power consumption, according to claim 57, wherein the effective priority is included as the most significant bits of the timer count and one or more user-identifier bits are included as the less significant bits.

59. The method for managing electric power consumption of claim 56, wherein each

smart user autonomously defines effective priority as a function of operating state and certain environmental information.

60. The method for managing electric power consumption, according to the claim 59, wherein the step of determining effective priority determines the effective priority as a function of one or more of the following:

i. user service duration;

ii. a program in course;

iii. a program step;

iv. remaining time to the end of the step;

v. possible program reconfiguration to request less power;

vi. habits of an associated consumer;

vii. timetable for service to end; and

viii. electric low-rate timetables.

61. The method for managing electric power consumption, according to the claim 59, wherein the effective priority associated with a given user varies in accordance with the level of available power.

62. A system for managing electric power consumption of electric users, the system including:

A. a set of smart users, with each smart user equipped with a control subsystem, said set of smart users being operatively connected to a power supply network;

B. a power meter for transmitting information on power consumption to the control systems;

C. the control system for a given smart user

i. assigning an effective priority value that is associated with the state of the given smart user, and

ii. assigning a right of access to the power consumption available from the power supply network based on the priority value and the information on power consumption transmitted by the power meter.

63. The system according to claim 62, wherein

the control system assigns the effective priority value based, in part, on calculations that use as a starting value a dynamic priority value allocated to the given smart user, and

the control system further includes a counter that is used in a competition procedure within the set of smart users, the counter controlling access to available power for the given user.

64. The system according to claim 63, wherein the effective priority value evolves in time as a function of the dynamic priority value.

65. The system according to claim 64, wherein

the power consumption required by the smart users is subdivided into power packets, and

the control system uses the effective priority value to decide the right of the given smart user to the consumption of power packets that are part of the power consumption available from the power supply network.

66. The system according to claim 64, wherein the control system further includes a counter that is initialised based on the effective priority value, the counter controlling the evolving of the effective priority value during the competition procedure

67. The system of claim 66, wherein the competition procedure involves a set of logic states, and in response to predetermined values of the power consumption information the system control reduces energy consumption and participates in a competition for increment state.

68. The system of claim 67, wherein the control system participates in the competition for increment state by establishing subsequent transitions among states based on an evaluation of the power consumption information at a time dictated by the counter.

69. The system of claim 68, wherein subsequent transitions are further based on power threshold values stored in the control system.

70. The system of claim 69, wherein the power threshold values are adjustable.

71. The system of claim 70, wherein the power threshold values can be adjusted individually for each smart user.

72. The system of claim 68, wherein a given transition includes taking a packet of available power from the supply network.

73. The system of claim 68, wherein a given transition includes a transition to a quies-

cent state.

74. The system of claim 73, wherein the effective priority is reset and subsequently incremented in the quiescent state.

75. The system of claim 63, wherein the control system reduces the power consumption of the smart user through deactivation.

76. The system of claim 67, wherein the control system, based on the information on power consumption, further performs a competition for decrement state to reduce energy consumption.

77. The system of claim 76, wherein the control system causes the effective priority to evolve in an opposite direction to the direction associated with the competition for decrement state.

78. The system of claim 76, wherein the control system, at the end of an associated count, executes a transition wherein a power packet is released.

79. The system of claim 66, wherein the control system deactivates the given smart user when the associated effective priority value is below a fixed threshold.

80. The system of claim 66, wherein the control system for a given smart user deactivates the user immediately based on the power consumption information when the associated effective priority value is below a predetermined threshold.

81. The system of claim 63, wherein the control system of the given smart user uses reduced load strategies and/or reduced consumption strategies based on the power consumption information.

82. The system of claim 2 wherein the control systems assign dynamic priority values that for a given smart user differ from the value assigned to other smart users in order to prevent the users from entering oscillation situations.

83. The system of claim 4 wherein the respective smart users draw power packets at different times to avoid entering oscillation situations.

84. A method for managing electric power consumption of a plurality of users, the method including the steps of

A. assigning each user an associated effective priority for access to energy consumption;
B. for each user, initialising a timer based on the effective priority; and
C. granting access to energy consumption to the user whose timer first terminates.

85. The method of claim 84, wherein the timer utilises a higher number of bits than the number of bits employed for defining the effective priority.

86. The method of claim 85, wherein the most significant bits of the timer correspond to the effective priority.

87. A method for managing power consumption of power users, the method includes the steps of:

A. associating each user with an effective priority for access to energy consumption,

B. at a given user autonomously defining an associated dynamic priority as a function of the operating state of the given user and environmental information; and

C. controlling the power consumption of the given user based on the effective and the dynamic priorities.

88. The method of claim 87 wherein in the step of defining the associated dynamic priority includes defining the dynamic priority as a function of information, such as user service duration and/or program in course and/or a program step and/or remaining time to end the step and/or possible program reconfiguration to request less power and/or consumer's habits and/or timetable for service to end and/or electric low-rate timetables.

89. The method of claim 88, wherein the dynamic priority is determined using elaboration circuits operating according to fuzzy logic principles.

REMARKS

Please cancel pending claims 1-32 and include claims 33-61 before examination.

Please charge any additional fee occasioned by this paper to our Deposit Account No. 03-1237.

Respectfully submitted,

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METHOD FOR MANAGING ENERGY CONSUMPTION OF HOUSEHOLD APPLIANCES

DESCRIPTION

The present invention relates to a method for managing power consumption of a users system, said users system comprising

- a set of users, comprising in turn a set of smart users equipped with control systems, said set of users being operatively connected to a power supply network;
- power measuring means, capable of transmitting information on power consumption to said control systems;

where the control systems perform power consumption control of the associated smart user on the basis of the information on power consumption transmitted by the power measuring means.

When simultaneous operation of a number of users in a given environment may require a greater resource availability than actually available, an automatic organization would be appropriate to limit the number of active users at the same time and/or impose a temporary reduced operation to all or just a few of them. Such a requirement is particularly felt for electrically supplied household appliances where said resource is the electric power available by contract from the Electricity Board. The automatic organization has to choose the users to be favoured from time to time based on fully accepted procedures (first come first served) or adopt any principles, which in a more or less complex manner will respect the priority levels assigned to the users during their performance.

Limiting consumption peaks is an appropriate measure resulting in significant savings ; in fact, power supply structures have to be oversized due to absorption peaks. For the person using the appliance (hereinafter referred to as "consumer") such a restriction may entail a saving, should over-consumption be subject to an electricity rate increase, or improved global performances, should over-consumption cause a current cut-off.

Of course, whichever such an automatic organization may be, it is assumed that more or

less smart users exist, i.e. capable at least of sending and/or receiving signals and modifying their state according to the signals received. However, also the presence of dummy users has to be inevitably provided in general, i.e. without the interactive capacities of smart users.

Systems are known, for instance, whose organization is obtained through a duly programmed central unit informed about the required data, which co-ordinates the users either by giving or by denying them the consent for full power activation or even a partial load. Among these, the most evolved central units also know how to manage the priority requirements for the services assigned to the users.

Such a control principle is expressed for instance in the patents US 4.324.987, US 4.418.333, US 5.544.036, US 5.4365.510, US 5.625.236, US 5.598.349, US 5.543.667.

Centralized power management through a co-ordination central unit (or power manager) has anyway several drawbacks, in particular due to the fact that if a users configuration changes (either by elimination, replacement or addition), also the central unit has to be reconfigured, as in the instance of the above patent US 5.436.510, where, additionally, a predetermined portion of the assigned power is always left available to not controllable or dummy users (such as irons, electric stoves, etc.), thus practically reducing constantly the power allowed for use.

Moreover, the global reliability level of such systems is at the most equal as for the central unit; if the latter becomes faulty, the whole system operation is jeopardized; in some environments, in particular in a household environment, a reduced user reliability just for the sake of integrating it in a complex services system cannot be accepted.

A clear improvement has been achieved by the system described in the Italian patent IT. 01279545 filed in the same Applicant's name, where a central unit is indeed provided, but having no co-ordination and control functions of the users, as it is restricted to supply essential information, i.e. maximum usable power, actual power used (measured in real time), likely electricity tariff at the moment if special timetable tariffs are provided, and so on. Said patent discloses smart users, intercommunicating mutual information on their own

requirements and priority levels; each smart user will take note of the requirements of the other users and either reduce or cancel its own absorption if sufficient power is not available and its own priority is not the highest among the ones mutually communicated, making way for the other ones. Of course, likely dummy users are unable to deal, i.e. they reserve highest priority to themselves, but will use power only while they are in operation, so that the system does not always need to reserve a power portion to them.

Such a power consumption organization represents a substantial progress, since the system regulates itself spontaneously, independently from any configuration change of the users set; in fact, the organization is not centralized, but it is the result of a "mediation" between smart users.

This notwithstanding, the procedure described above has some drawbacks due to the very high number of information to be communicated among the users and complex elaboration requested of each smart unit.

It is the object of the present invention to solve the above drawbacks and provide a method for managing power consumption of a users system, having a more efficient and improved performance.

In this frame, it is the main object of the present invention to provide a method for managing power consumption of a users system, which avoids exceeding a predetermined power threshold globally absorbed by said set of smart users, controlling their consumption on the basis of their own rules and internal information as well as on regular information supplied by a central unit.

A further object of the present invention is to provide a method for managing power consumption of a users system, which in case of faulty central unit or of one or more of said "smart" users will warrant no less operation reliability of the remaining users than obtainable if said central unit were missing.

A further object of the present invention is to provide a method for managing power consumption of a users system. which ensures a stable system, letting the users terminate their duties within reasonable times without jeopardizing their performance nor increasing

global consumption and moreover preventing the arising of oscillations.

In order to achieve such aims, it is the object of the present invention to provide a method for managing power consumption of a users system incorporating the features of the annexed claims.

Further objects, features and advantages of the present invention will become apparent from the following detailed description and annexed drawings, which are supplied by way of non limiting example, wherein:

- Fig. 1 shows schematically a household electric installation with a set of users according to the present invention;
- Fig. 2 shows a states diagram related to a first embodiment of the method for managing power consumption of a users system according to the present invention;
- Fig. 3 shows a states diagram related to a second embodiment of the method for managing power consumption of a users system according to the present invention;
- Fig. 4 shows a diagram representing absorbed power ranges related to the method for managing power consumption of a users system according to the present invention;
- Fig. 5 shows the qualitative trend of a quantity employed in the method for managing power consumption of a users system according to the present invention;
- Fig. 6 shows a value assignment table of a second quantity employed in the method for managing power consumption of a users system according to the present invention;
- Fig. 7 shows a second table related to the quantity of figure 6;
- Fig. 8 shows a third table related to the quantity of figure 6:
- Fig. 9 shows a quantity trend of figure 6 as a function of time;
- Figs. 10-11-12 show three possible configurations of a device employed in connection with the power method for managing power consumption of a users system according to the present invention.

Figure 1 shows a power distribution system in a household environment, where electric power is drawn from an external network RE through an electric power meter CE and restricted by a power limiter LP to the value provided in the electricity supply contract (3

kW in the above example).

Four current sockets indicated with PR supply an equal number of users U, i.e. a laundry wash-machine LB with 2 kW power, a dishwasher LS with 2.4 kW power, a baking oven FO with 2.8 kW power and an iron FS with 2 kW power. The electric meter CE, laundry wash-machine LB, dishwasher LS and oven FO are all supplied from the electric network through a suitable electronic interface IN, which is provided to let information transmission and reception through the electric network utilizing carrier modulation waves. On the other hand, any known communication means can be used for the achievement of the present invention.

The electric meter CE is capable to send at regular time intervals the value of an Available Power PD to the users, e.g. every minute, and/or in line with a relevant change of power absorption. In the following, such a generic information means obtained according to the known state of the art and identifiable with its associated electric counter CE, whose description is contained in the above patent IT. 01279545, will be called Measuring Node NM.

Both the laundry wash-machine LB, dishwasher LS and oven FO are equipped with corresponding control systems called SC1, SC2 and SC3, respectively, in communication with the electronic interfaces IN. According to the present invention, such control systems, generally called in the following SC, are able to manage in a completely autonomous way power consumptions of the user they are associated with. On the contrary, according to the control systems described in the patent IT. 01279545, users are able to exchange information mutually useful. in a co-operation-like manner, such as water hardness, humidity and room temperature.

From now on, the expression smart user UI will indicate indifferently all users U capable of performing the functions provided in the present invention, i.e. equipped with the Control System SC, whereas the other users are called dummy users UNI.

Optimal consumption distribution is obtained instructing the Control System SC of each user UI to obtain the power required according to a coherent behaviour with its momentary

need to perform or not its assigned service; in other words, the behaviour of each user UI is exclusively conditioned by the priority level, instant by instant, of the performance of its service and actual availability of the required power.

This is provided causing the Control System SC of every smart user UI to take decisions about the behaviour of the smart user UI itself, simply basing the decision on the Available Power PD value at the moment and on the value of a parameter called Effective Priority PriorEff, calculated by the Control System SC itself.

According to the present invention, in most Control System SC states the Effective Priority value PriorEff is equal to a quantity called Dynamic Priority PRD. Also said Dynamic Priority PRD is calculated by each Control System SC on the basis of specific predefined instructions for each smart user UI, on internal information related to the state of the smart user UI itself (such as program steps, monitored temperatures, etc.), and finally on external information supplied by the Measuring Node NM.

Summarizing, the Control System SC state depends on Available Power PD communicated by the Measuring Node NM and Effective Priority PriorEff value calculated by the Control System SC itself; Effective Priority PriorEff in turn takes values, which may also depend but not necessarily on the information received from the Measuring Node NM.

Then, the Measuring Node NM, as it will become apparent later, does not absolutely impart any command to smart users UI, but it will restricts itself to supply the same information to all of them conditioning their behaviour indirectly only, since smart users UI themselves will take received information into account for modifying their state, if required. Moreover, the Control System SC state of each user UI is not conditioned by a transaction with other users UI, as occurring on the contrary in the system described in the patent IT. 01279545.

According to the present invention, in fact, each smart user UI acts quite autonomously, regardless of the requirements of other smart users UI or dummy users UNI.

The global behaviour of smart users UI and dummy users UNI is very similar to that of a population of individuals or cellular automata where a substantially stable regular total

result may not be the result of a predetermined design but rather of uncoordinated individual actions that share only common behaviour rules.

According to a first embodiment of the present invention, the Control System SC of each smart user UI uses a first principle to take the required power for operation. called "Competition for Increment".

According to a second embodiment of the present invention, the Control System SC of each smart user UI uses a second principle to take the required power for operation, called "Competition for Decrement".

According to the present invention, the Measuring Node NM is provided for constantly measuring an Absorbed Power PA, i.e. the electric power actually absorbed by the users U and, moreover - knowing the subscribed power supply PC, i.e. the maximum electric power usable according to the electric supply contract - transmitting information to the smart users UI on Available Power PD at sufficiently closed time intervals.

Figure 5 shows the information trend on Available Power PD as a function of time t. Since the magneto-thermal switches allow the contract supply power PC to be exceeded to a certain extent before power is cut off, such a contract supply value is not exceeded immediately but with a delay. which will be the higher the less the absorption excess; then not necessarily the Measuring Node NM will send the negative Available Power PD message as soon as Absorbed Power PA exceeds the contract supply power PC. Therefore, Available Power PD value may be a signal reprocessed by the Measuring Node and a function of an over-consumption PC-PA and duration of said overconsumption, and finally of the tolerances established by the Electricity Board for the magneto-thermal switch to operate.

Figure 5 shows in fact an example with a constant negative over-consumption PC-PA, while Available Power PD. as function f (PC, PA, t), will decrement in time when the over-consumption condition goes on until a negative value is reached,.

According to the present invention, when this situation occurs and the measuring node NM sends a negative Available Power PD message, active smart users UI receive said

information of negative Available Power PD and perform a competition process between themselves. At the end of the competition process, some smart users UI, generally but not necessarily those with the highest Dynamic Priority PRD value, take all or a major part of the power they require, whereas other users will only take a minimum quantity as necessary for operation, and other users have not yet enough power to operate and go to a QUIESCENT State letting the first ones terminate their program without any interferences. With regard to the above minimum power quantity necessary for operation, it will be appreciated how according to the teachings of the present invention it is eventually possible to get advantage from the fact that some users may decide for either Reduced Consumption or Reduced Load operating strategies.

A Reduced Consumption strategy provides the same power absorption of the user as during normal operation but for a shorter time, thus reducing consumption. For instance, a washing machine LS can wash at a slightly lower temperature than usually required, because extension of mechanical wash times warrants the same performances; therefore, if the machine is informed through a poor Available Power PD information that other users request power, it may choose alternative wash strategies to the basic one, deciding for lower wash temperatures and longer wash times, which will use power for less time and allow earlier activation of other users.

On the contrary, a Reduced Load strategy provides substantially the same energy consumption of the user as during normal operation, but using less power and consequently a longer time. For instance, an electric buffer water-heater or electric stove equipped with two or more electric heaters may have a slower heating process choking the load, thus using less power for a longer time, so as to allow operation in parallel of other users.

Summarizing, some smart users UI may operate at different consumption levels or with a Reduced Load using either the same power for a longer or shorter time or one or more power "packets" ΔP; the time during which power is requested may be shortened letting other users switch on earlier, or the power used may be reduced to let other users switch in simultaneously. Of course, such strategies entail some sacrifices in terms of quality or

energetic cost of the service, but will improve the coexistence of several users.

It will become apparent, in the following, how according to the present invention, it is extremely simple to utilize such strategies for reducing conflicts between users.

The principle for establishing the winning users UI in a competition process, which have the right to access to power consumption during competition is obtained by the result of actions conditioned by Effective Priority PriorEff assigned to each smart user UI. Effective Priority PriorEff of a user UI is variable in time and reflects the task difficulty of a user UI in its evaluation moment, which difficulty is represented in turn by Dynamic Priority PRD. Dynamic Priority PRD is an integer value comprised between 0 as Null Priority PRN value and 2^n-1, Maximum Priority PRM, where n is the number of bits used to represent said Dynamic Priority PRD; thus, Dynamic Priority PRD expresses the urgency for each user to perform a determined service.

Principle of Competition for Increment

The operating procedure according to Competition for Increment is now illustrated with reference to figure 2.

With reference to figure 5. Available Power PD will mean in the following the function f (PC, PA, t); therefore, when Available Power PD is said to be either negative or positive to indicate an over-consumption or not, this means that the corresponding function f (PC, PA, t) will take either negative or positive values.

The arrows marked T.1 to T.8 indicate possible State Transitions, said States being identified S.1 to S.4. The relevant conditions for Transitions are indicated in bold letters in line with each transition; underneath them are the operations executed by the Control System SC. In said figure 2, as in the subsequent figure 3, the quantities indicated with the symbol "[i]" represent specific values related to the user "i"; whereas the remaining quantities may have a common value for all control systems SC. In particular, the following quantities are shown, whose meaning will be explained later:

- Actually absorbed power Pot[i]. i.e. the power absorbed by the smart user UI, evaluated by the relevant Control System SC through known means;

- Power packet $\Delta P[i]$, which is a discrete from time-to-time variable power quantity, to which the winning smart user UI in Competition for Increment can have access;
- Minimum power PMin[i], which is the minimum power a smart user UI can use to perform a service or a function;
- Maximum power PMax[i], which is the maximum power required by the user UI to perform the same service or function;
- User's Effective Priority PriorEff[i];
- Available power PD as defined above;
- Power thresholds K0 and K1;
- Priority thresholds PrioMin and PrioMax.

In all states taken by the Control System SC, Effective Priority PriorEff is equal to Dynamic Priority PRD, save for QUIESCENT State S.3 and WAIT state S.4.

Let us assume to have a generic smart user UI normally working in a generic instant. When said smart user UI switches on, its Control System SC is in ON State S.1 and the operation strategy chosen is the standard one, i.e. requesting all required power and energy. Control System SC is informed at time intervals on available power PD; during such a State S.1 it may receive along with the other users UI an overload signal, i.e. Available Power PD < 0.

Transition T.1 from ON State S.1 to COMPETITION FOR INCREMENT State S.2.

Upon receiving the overload signal, Control System SC goes to the COMPETITION FOR INCREMENT State S.2. Prior to Transition T.1 it will deactivate the loads of its smart user UI, save for a minimum absorption required for a "stand-by" state (controls, warning lights, etc.), set its Effective Priority PriorEff on the value of its current Dynamic Priority PRD, set a timer called Priority Timer TP on the value of Effective Priority PriorEff and process a Reduced Consumption operating strategy, if provided for that user type. Also the other smart users UI, having received the same Available Power PD value and being equipped with a similar Control System SC will perform the same transition T.1 and substantially reach COMPETITION FOR INCREMENT State S.2 in the same instant. Of course, at the same time Available Power PD has probably become a positive power as all

users U have been deactivated. except for the dummy ones UNI.

Once COMPETITION FOR INCREMENT State S.2 is reached, Control System SC of each smart user UI will increment its own Priority Timer TP, being the increment speed associated with each user UI properly determined based on experience data. Four possible transitions are available to exit this state.

Transition T.2 from COMPETITION FOR INCREMENT State S.2 to COMPETITION FOR INCREMENT State S.2

The Priority Timer TP reaches count end, i.e. the Maximum Priority PrioMax value equal to 2^{n-1}, identical for all smart users UI, and verifies that Available Power PD current value with a sufficient pre-set safety margin defined by the power threshold K0 is higher than a first value, called power packet ΔP[iI]=PMin[i]. which allows operation at a first Reduced Consumption level, draws such a power amount or packet ΔP[i], sets the Priority Timer TP again on its Dynamic Priority PRD current value and goes back to COMPETITION FOR INCREMENT State S.2. This Transition T.2 may be executed several times if various Reduced Consumption operating strategies are available for said user, each one characterized by power packets ΔP[i] generally differing from each other.

If the smart user UI has undergone no interferences, at the end of several Transitions T.2 it will have been assigned the whole maximum power PotMax provided by its Control System SC for a full-load operation strategy, though operating according to a Reduced Consumption strategy, if provided.

Transition T.3 from COMPETITION FOR INCREMENT State S.2 to QUIESCENT State S.3.

The Priority Timer TP reaches its count end as in the previous instance and ascertains that the power actually absorbed Pot[i] is lower than the minimum power PMin[i], which allows performance of any Reduced Consumption operating strategy, i.e. the power currently absorbed Pot[i] is the lowest one required by the user for its stand-by condition (warning lights, Control System SC, etc.). As it is apparent, the user UI was not in time, nor will now be able to take power packets ΔP[i], which have gone to other users with a

higher Dynamic Priority PRD. In such a situation, Control System SC goes to QUIESCENT State S.3: its Effective Priority PriorEff is reset and then slowly incremented; as long as the smart user UI has not reached a minimum value it cannot activate any of its loads. This will prevent oscillations and warrant stability. In fact, if after a competition the users UI that were unable to take power packs ΔP[i] are allowed to be reactivated as soon as there is Available Power PD, they may insert themselves for instance during a thermalization step of the oven FO, cause a new competition and then a cycle trend, which will not let any user operate efficiently. On the contrary, since in order to warrant efficiency the user that started a function must be able to end it in a short time, so it should not be disturbed.

Effective Priority PriorOff value that was reset in Transition T.3 will be incremented to exceed priority threshold PriorMin. Such a value, based on experience, must be sufficiently high to avoid any interferences to other users with priority at the moment; before exceeding such a value, as said, the user is not allowed to attempt procuring any power not even if Available Power PD is high enough.

Transition T.4 from COMPETITION FOR INCREMENT State S.2 to COMPETITION FOR INCREMENT State S.2.

Should Available Power become negative at any time as in the condition originating Transition T.1, the loads are deactivated refraining from drawing power packets ΔP[i] possibly won during one or more Transitions T.2, the Priority Timer TP is set again on the Effective Priority PriorEff value, and then back again to COMPETITION FOR INCREMENT State S.2.

Transition T.5 from COMPETITION FOR INCREMENT State S.2 to ON State S.1

Should Control System ascertain at any time, but certainly at the end of at least a Priority Timer TP count, that an actually absorbed power Pot[i] has been assigned, equal to PotMax[i] required for full-load operation, then Control System SC can go back without delay to the ON State S.1.

Transition T.6 from QUIESCENT State S.3 to WAIT State S.4

This occurs when Effective Priority PriorEff has exceeded the Priority Threshold PrioMin and allows transition to the WAIT State S.4, wherefrom it is possible to return to competition. This occurs in two ways. as follows.

Transition T.7 from WAIT State S.4 to COMPETITION FOR INCREMENT State S.2.

This occurs if Available Power PD value exceed the value PMin[i], plus a safety margin according to the power threshold K1, which can perform a Reduced Load operating strategy. Effective Priority PriorEff is set equal to Dynamic Priority PRD, the user started at Reduced Load (Pot[i] = PMin[i]) and the Priority Timer PT set.

Transition T.8 from WAIT State to the ON State S.1.

Provocatively, if Effective Priority PriorEff exceeds the Maximum Priority PrioMax value equal to 2^{n-1}, it goes to maximum load, i.e. to the ON State S.1; this will surely cause other state transitions of the other active smart users UI towards COMPETION FOR INCREMENT S.2 wherefrom, this time, the smart user UI in question will have more chances to be the winner, since meanwhile its Dynamic Priority PRD value has certainly increased.

It will be remembered how in the first transition T.1 the user UI had reached a Reduced Load operating strategy wherefrom no change of the Control System SC has caused its exit: in fact, if this choice is made it is advisable to maintain it until service end (e.g. wash program) when it will finally be deactivated; anyway, nothing hinders to provide that before returning to the ON State S.1 the Control System SC will take the user UI back to a standard consumption strategy.

Principle of Competition for Decrement

With reference to figure 3 an embodiment of the present invention is now described, which provides a behaviour diagram called "Competition for Decrement".

The states provided for the Control System SC are substantially identical to those of the simple "Competition for Increment". save adding a further "Competition for Decrement" state S.6, wherein the users with a lower Dynamic Priority PRD are caused to leave the power conquest competition.

As seen above, "Competition for Increment" is a power assignment race of users UI; when Available Power PD becomes negative, all users UI will deactivate their loads and gradually reactivate until the whole power is allocated in an optimal way. The advantage of this method consists in simultaneous deactivation of all users UI, so that the magneto-thermal switch will not operate. However, a drawback is that during a lapse of time lasting 30 to 60 seconds also operation of higher priority users will be interrupted.

The problem can be solved according to the principle "Competition for Decrement", i.e. the users are not immediately deactivated, the Priority Timer TP counts backward and upon resetting the user releases a power packet $\Delta P[i]$. The user UI goes over to a QUIESCENT State S.8 if deprived of the minimum power PMin required, it returns to ON state S.5 if Available Power PD is positive and had not to release a power packet ΔP, and it remains in a competition state as long as one of these conditions will not occur. The diagram is modified as follows with respect to figure 2:

A COMPETITION FOR INCREMENT State S.7 is always provided, whose output transitions are similar to the ones represented in figure 2, but not detailed here for simplicity's sake. State transitions of COMPETITION FOR INCREMENT S.7 and COMPETITION FOR DECREMENT S.6 have been submitted to a "hysteresis" to prevent oscillations between both states. Exiting a Wait State is similar to "Competition for Increment", i.e. energy packets ΔP will be assigned to the user UI as soon as they become available.

Control System SC states are as follows:

S.5: ON STATE

Action: operation according to the current program

S.6: COMPETITION FOR DECREMENT STATE

Action: decrementing Timer Priority TP, operation level restricted to the level permitted by active loads

S.7: COMPETITION FOR INCREMENT STATE

Action: incrementing Timer Priority TP, operation level limited to the level permitted

by active loads

S.8: QUIESCENT STATE

Action:Incrementing Effective Priority PriorEff

S.9: WAIT STATE

Action: Incrementing Effective Priority PriorEff.

The above state transitions, their conditions for occurring and implied actions are listed as follows: many transitions are conditioned whether Available Power PD exceeds or not power threshold values K2, K3 and K4, which delimit the power using ranges as shown in the diagram of figure 4.

In fact, it is possible to establish a tolerance threshold for Available Power PD, namely threshold K2. This threshold K2 is higher than threshold K3; the latter is a minimum, void or negative threshold as represented in figure 4, below which the users system U will reach an overload. When power absorption is such to let Available Power PD go below the threshold K2, smart users UI with a low priority will immediately deactivate some loads to bring consumption level back within safety limits; such an event is better than immediate deactivation of all loads, the latter being more appropriate for an emergency situation.

Moreover, preventive deactivation of some loads when PD>K2 will reduce likely emergency operations.

If the consumption level decreases too much (PD>K4), the users go over to Competition for Increment and have the opportunity of winning power packets again. Therefore, consumption is maintained at an optimal level, such as K2<PD<K4.

T.9: transition from ON State S.1 to COMPETITION FOR DECREMENT State S.6

Condition: the Measuring Node NM sends a message of Available Power PD PD<K2 (poor Available Power PD or a users system U approaching over-consumption).

Actions: setting Priority Timer TP on Dynamic Priority PRD current value, processing a Reduced Consumption strategy, if feasible.

T.10: transition from ON State S.5 to COMPETITION FOR INCREMENT State S.7

Condition: the Measuring Node NM sends a message of Available Power PD <K3 with K3<K2 (negative Available Power PD or system in over-consumption).

Actions: loads deactivation, setting Priority Timer TP on Dynamic Priority PRD current value, processing a Reduced Consumption strategy, if feasible. As it can be seen, since K3<K2, this condition is more critical with respect to the event determining the transition T.9 and will request immediate deactivation of all loads.

T.11: transition from COMPETITION FOR DECREMENT State S.6 to ON State S.5.

Condition: the Measuring Node NM sends a message of Available Power PD > K2 (Available Power PD exceeding the safety threshold) while the user UI is still using all maximum power PotMax provided by its program).

Actions: not provided.

T.12: transition from COMPETITION FOR DECREMENT State S.6 to COMPETITION FOR INCREMENT State S.7.

Condition: the Measuring Node NM sends a message of Available Power PD > K4 (enough Available Power PD for reactivation of some loads without the risk of approaching over-consumption).

Actions: not provided.

Transition T.12 does not require Priority Timer TP to be reset.

T.13: transition from COMPETITION FOR DECREMENT State S.6 to COMPETITION FOR INCREMENT State S.7.

Condition: the Measuring Node NM sends a message of Available Power PD< K32 (unsufficient Available Power PD or system in over-consumption, PD<0)

Actions: loads deactivation, setting Priority Timer TP on Dynamic Priority PRD current value;

As it can be seen from the State S.6 it goes over to the State S.7 due to both Available Power PD and over-consumption: in one event the users will maintain active loads and be able to get more power, in the other everything will be deactivated.

T.14: transition from COMPETITION FOR DECREMENT State S.6 to COMPETITION FOR DECREMENT State S.6

Condition: Priority Timer TP at count end and PD < K2 (system approaching over-consumption), the user UI releases a power packet ΔP. According to a possible embodiment, the user UI will deactivate one load only in the event of the power parcel ΔP so released being a significant fraction of the contract supply power PC. This solution helps protecting lower priority and low consuming smart users UI, which do not lead to any significant contribution when deactivating themselves. Of course, in the Competition for Increment State S.7 they are safeguarded, since though reaching count end later, they can also benefit of lower power levels left unused by other users requiring for instance 1 or 2 kW.

Actions: The user UI does not change its state, it releases the power packet ΔP[i] and sets the Priority Timer TP on Dynamic Priority PRD current value. An embodiment related to utilization of the Priority Timer TP, shown in the following, provides both events in separate moments, i.e. power packet ΔP[i] release and Priority Timer TP setting, though they should be logically considered part of just one transition.

T.15: transition from COMPETITION FOR DECREMENT State S.6 to QUIESCENT State S.8.

Condition: Priority Timer TP at count end and Pot[i] < PMin[i] + k2: the user UI has lost competition.

Actions: resetting Effective Priority PriorEff value (PriorEff[i] = 0.

T.16: transition from COMPETITION FOR INCREMENT State S.7 to COMPETITION FOR DECREMENT State S.6

Condition: The Measuring Node NM sends a PD<K2 message (either poor Available Power PD or system approaching over-consumption); K2 < K4 is assumed to avoid oscillations between States S.6 and S.7.

Actions: none

T.17: Transition from QUIESCENT State S.8 to WAIT State S.9

Condition: PriorEff[i] > PrioMin

Actions: none

T.18: Transition from WAIT State S.9 to COMPETITION FOR INCREMENT State S.7

Condition: PD>PMin[i]+K2 and PD > K4

Actions: Setting Priority Timer TP, Pot[i] = PMin[i].

As it can be seen, PD>K4 condition ensures that no users will go over to Competition for Increment as long as other users are still in Competition for Decrement.

T.19: Transition from WAIT State S.9 to ON State S.5

Condition: PriorEff[i]>PrioMax

Actions: activation of all loads provided.

The following transitions are similar to the transitions already described in figure 2 for analogous states; both the conditions and actions they refer to are omitted in the Diagram of figure 3 for simplicity's sake.

T.20: Transition from COMPETITION FOR INCREMENT State S.7 to ON State S.5

Condition: the Measuring Node NM sends a PD>K2 message (Available Power PD exceeding the safety threshold) and the user is already using the whole power provided by its program.

Actions: not provided.

T.21: Transition from COMPETITION FOR INCREMENT State S.7 to COMPETITION FOR INCREMENT State S.7

Condition: the Measuring Node NM sends a PD>K3 message (negative Available Power PD or system in over-consumption)

Actions: loads deactivation, Priority Timer TP setting on Dynamic Priority PRD current value.

T.22: Transition from COMPETITION FOR INCREMENT State S.7 to COMPETITION FOR INCREMENT State S.7

Condition: Timer at count end and PD > $\Delta P[i]$ + K2

Actions: $Pot[i] = Pot[i] + \Delta P[i]$

T.23: Transition from COMPETITION FOR DECREMENT State S.7 to QUIESCENT State S.8.

Condition: Timer at count end and $Pot[i] < PMin[i] + K2$: the user has lost competition.

Actions: Dynamic Priority PRD value is reset.

According to an embodiment, the Control System SC in the Competition for Decrement principle may also operate without transitions T.10 and T.13; however, the reaction to an over-consumption situation is slower with the risk that the magneto-thermal switch could intervene.

According to an embodiment of the present invention, threshold power values K0, K1, K2, K3 and K4 may be modified at any time should it be necessary to correct the behaviour of smart users UI, so as to let them be transmitted by the Measuring Node NM to all Control Systems SC; thus, modification of the global behaviour of smart users UI will be quite simple.

As already noticed with reference to figure 5, another embodiment of the present invention may take into account that the magneto-thermal switch does not immediately trip in the event of a power over-consumption, but it undergoes a delay, which is much higher the less over-consumption will be. Transitions depending on evaluations of Available Power PD, such as T.9, T.10, T.11, T.12, T.13, T.16 of figure 3, may not be immediate, but occur with a delay, which is much higher the less the value of limit excess will be. This can be obtained having the Available Power PD value transmitted by the Measuring Node NM not simply equal to the difference PC – PA, but a more complex function f always of PC and PA and of over-consumption duration t as well. The function f can be very well calculated in the fuzzy mode or based on written values of a Table. A system responding to the real over-consumption value and its duration will utilize the low-pass filter feature of the magneto-thermal switch, making the system more stable and free from impulsive

absorption loads.

From the above description it is possible to change the global behaviour of the users set U to render it more or less alarmist simply amending the principles used by the Measuring Node NM to calculate the transmitted available Power PD value. This may occur at any future time without causing an instructions change to the Control Systems SC of users UI.

Figures 2 and 3 show Control Systems SC behaviour in detail to prove feasibility of the teachings contained herein by way of example, although more complex amendments to the basic diagrams called "Competition for Increment" and "Competition for Decrement" are possible.

By way of example, a third embodiment is possible, where upon exceeding the contact supply power PC only the users UI with a priority below a threshold will be deactivated. If following this deactivation Absorbed Power PA is lower than the contract supply power PC, then smart users UI will remain in ON State, whereas the deactivated users go over to the COMPETITION FOR INCREMENT State. If, on the contrary, Absorbed Power PA is still higher than the limit, active users UI go over to the COMPETITION FOR DECREMENT State and the deactivated users to QUIESCENT State. A balance can be reached faster with this method; however, since a preliminary priority based exclusion takes place, it may happen that a low priority and low consuming smart user UI is deactivated uselessly, i.e. without releasing enough energy to any other user.

Finally, a fourth embodiment is obtained if the cut-off priority threshold depends on an over-consumption value.

Summarizing, four procedures have been defined according to which competition may occur following Available Power PD, as listed below:

1. **Competition for Increment**

   As described in figure 2, all loads are deactivated when a timer inside each user expires, each user wins a power packet and the process ends as soon as there is no more Available Power PD.

2. **Competition for Increment or Decrement**

As described in figures 3 and 4, users UI will all enter competition for Increment or Decrement based on the Absorbed Power PA value exceeding the contract supply power limit.

3. **All users UI whose priority is below a fixed threshold are immediately deactivated**
   a) If, after deactivation, instantaneous Absorbed Power PA is lower than the contract supply power PC, then the still active users UI are in ON State and the others in the Competition for Increment State.
   b) If, after deactivation, instantaneous Absorbed Power PA is higher than the contract supply power PC, then the still active users UI are in Competition for Decrement State and the others in QUIESCENT State.
4. **All users UI whose priority is below a threshold related to an over-consumption value are immediately deactivated**
   a) If, after deactivation, instantaneous Absorbed Power PA is lower than the contract supply power PC, then the still active users UI are in ON State and the others in Competition for Increment State.
   b) If, after deactivation, instantaneous Absorbed Power PA is lower than the contract supply power PC, then the still active users UI are in Competition for Decrement State and the others in QUIESCENT State.

Solutions 3) and 4), though having a higher complexity, offer the advantage of warranting balance achievement within a shorter time. In fact, some users UI are instantaneously deactivated, some remain active and only the power for intermediate priority users UI will have to be allocated. However, adopting this procedure one of the advantages offered by Competition for Increment will be lost, i.e. optimal power allocation. In Competition for Increment, in fact, a low priority and low consuming user UI has the possibility of going back to operation if the power used by it is too low for activating any other user UI. Moreover, in order to reach allocation of Available Power PD, these solutions have to go through a competition stage. Lacking a central controller, the procedure chosen for optimal allocation is to induce each user UI to proceed iteratively in one direction until the

engagement for the contract supply power PC has been fulfilled, without requiring a priority threshold, which is neither a fixed one nor over-consumption based to decide in advance which user should be deactivated or not.

The rules determining state transitions hinder a possible coexistence of users in Competition for increment State with others in Competition for Decrement State. This operation would not be a reasonable one as it could generate users subsets reaching the balance in an autonomous, not mutually coherent, manner; priority constraints would be respected only within such subsets, but not in absolute. These two states cannot coexist in a system, since Competition for Increment and Competition for Decrement state transitions are activated by equal conditions for all users; as a result, if a user goes over to one of the two states also all the other ones will go over, unless they are in a Quiescent or Wait state.

It should be noticed that as long as there are users in the Competition for Decrement State, there will be no verification of the condition causing users to enter a Competition for Increment.

Dynamic Priority PRD

Elaboration methods of Dynamic Priority PRD values are now described, which are referred to by each Control System SC in the Competition States.

All useful information for determining current dynamic priority PRD of each smart user UI are directly processed by the smart user UI itself. Several variables are combined in one information alone, i.e. dynamic priority PRD, thus solving complexity at local level, without overloading the system and without requiring a central direction. Dynamic Priority PRD, on its own, contains high level information, i.e. to what extent more or less power should be warranted to each user.

In order to represent "rich" information and prevent possible conflicts between the users, Dynamic Priority PRD is a continuous "variable" or more exactly it can take any integer value from 0 to 255 or in general 0 to 2^n, if n is the number of available bits for storing and communicating such information. Moreover, Dynamic Priority PRD is exactly "dynamic", i.e. it is calculated in real time by a fuzzy system contained in Control System SC as a

function of parameters, such as :

- Duration of user service
- Program in course
- Programme step
- Remaining time to end the step
- Possible program reconfiguration to request less power
- Consumer's habits
- Requested time to end the service
- Electric current special time rates

The Dynamic Priority PRD value is not preferably deducted according to a mathematic calculation, but is rather defined by a process expert of each single user; therefore, Dynamic Priority PRD is calculated by a fuzzy system representing the expert's knowledge. This method allows utilization of the fuzzy inferential motor already available in the microprocessor of the Control System SC of the user UI, thus optimising both the memory occupancy and performance.

Figures 6, 7. 8 and 9 show some orientative non limiting examples of the principles for assigning the values to Dynamic Priority PRD using fuzzy systems. In particular, figure 6 shows a Table TB6 reporting an example of values assignment to Dynamic Priority PRD, which favours some users UI to the detriment of other users.

Figure 8 shows a Table TB8 reporting an example of values assignment to Dynamic Priority PRD, which avoids interrupting a delicate wash process, such as a woollens wash cycle; in figure 7 a table TB7 shows two examples of logical proportions for a wash process where the Dynamic Priority PRD value depends on both the type of fabric and heating step progress. Figure 9 shows Dynamic Priority PRD trend in time for a laundry wash-machine during a heating step; as it can be seen, Dynamic Priority PRD provides a tolerance for load deactivation at the beginning and at the end of the heating step, but not in correspondence with the main step where deactivation may lead to a dispersion of the energy just used for the heating step.

Dynamic Priority PRD calculated as above is used through Effective Priority PriorEff any time a Priority Timer TP count is performed.

In the QUIESCENT and WAIT states, on the contrary, Effective Priority PriorEff is a fictitious value apart from the above parameters and is incremented in time with principles based on experience and not necessarily identical for each type of smart user UI. The simplest solution would be to provide a fixed increment for each user; however, a better solution is to calculate the increment as a function of the Dynamic Priority PRD that a smart user UI would have if not in ON State. For instance, the increment may equal a fraction of the Dynamic Priority PRD.

Priority Timer TP

Occasionally, two smart users UI may have an equal Dynamic Priority PRD; in this event it should be avoided to have them attempting to take a power packet simultaneously, as this would cause a new overload and lead the system to a oscillations state. It must be stated that in order to represent Dynamic Priority PRD $256 = 2^8$ values are enough, but not strictly required. The event where 8 bits are used is explained in the following non limiting example, but the method shown can be used in general for a lower number of bits.

A first method to solve the conflict between two users UI with equal Dynamic Priority PRD is to hinder smart users PD from having an equal priority PRD, limiting the values between the various users, i.e. if smart users are m, with m being an integer, the i-th user UI can only take integer values as Dynamic Priority PRD values $(i - 1) + m*k$, where k is an integer comprised between 0 and the ratio integer part $(2^n-1)/m$ reduced by one unit, i.e. maximum $k = INT[(2^n-1)/m]-1$, where n is the number of bits.

For instance, if n = 8 and users UI are m = 7, the first user UI can take the following 36 values of Dynamic Priority PRD, i.e. 0, 7, 14, etc. up to 245; the second user will take other 36 values, i.e. 1, 8, 15, etc., up to 246, and so on.

If the set of users UI is a large one and consequently also m value is high, the drawback is that there will be a strongly reduced possibility of expressing different Dynamic Priority PRD values, e.g. for 10 smart users UI they will be reduced to 25.

A second method for solving the conflict between two users UI with equal Dynamic Priority PRD is to share the time interval available for users UI to take energy packets in m intervals, each one reserved for a user UI.

For both methods each user UI will be assigned a progressive number I; this can be done manually during installation, but it will be easier automatically, i.e. during a first installation each new user UI may communicate its own presence to the Measuring Node NM, which reacts assigning the newcomer a progressive order number i. which is equal to the number of smart users UI already installed plus one.

With reference to figures 10, 11 and 12, it will be seen how these two methods can be optimised using them combined together to develop a third method, where the resources of the microprocessor contained in the Control System SC are utilized without limiting the 256 priority values and without complications for the control program.

While Dynamic Priority PRD like Effective Priority PriorEff is represented with 8 bits, the Priority Timer TP is a 16-bit counter. so that the 8 less significant bits can be used to differentiate each user UI through its address, which is unique and assigned during installation.

More in detail. as shown in figure 10, when competition starts the 8 most significant bits P8, P7 ... P1 of the Priority Timer TP ("priority bits" in the following) are initialised at Effective Priority PriorEff current value, so that the Priority Timer TP value will substantially depend on Effective Priority PriorEff. The 8 less significant bits ("address bits" in the following) are set to zero. as cab be observed in figure 10.Let us assume in an orientative non limiting way that the effective address is expressed by 3 bits alone. I3 I2 I1 (it will be clear in the following which values are taken by the remaining "address bits"). This first setting of the Priority Timer TP occurs simultaneously for all the users deriving from a low Available Power PD situation.

During the Priority Timer TP count, the 8 address bits will scan all values from 0000.0000 to 1111.1111 for each increment of the 8 priority bits; since they all started simultaneously from the same value (in the specific instance 0000.0000), they always maintain the same

value during counting. Therefore, the instants in which the 8 address bits take the configuration I3 I2 I1 1.1111, each one with its own address, they will always be different for all users. Assignment of a power packet occurs when the 8 most significant bits are at 1 and the 8 less significant bits in the configuration I3 I2 I1 1.1111 (see figure 11), i.e. at different times for each user UI.

When a Priority Timer TP reaches configuration 1111.1111.1111.1111, it is reset to the new value P8', P7', ... P1' taken by Effective Priority PriorEff in the meantime, whereas the address bits are reset as shown in figure 12. Simultaneously, also the 8 address bits of the other Priority Timers TP will be at 1111.1111 and obviously reset in the subsequent instant. Therefore, the address bits of all Priority Timers TP always maintain the same value also after resetting.

The procedure described above is orientative and not limiting, i.e. the basic idea can be executed using different values for setting and final address bits configuration. It is essential to have the 8 most significant bits express Effective Priority PriorEff and the 8 less significant bits remain synchronized to each other so that the instant when they take a typical configuration this is necessarily different from the others and can be used as an instant for assigning a power packet, i.e. a second timed scansion. It should be noticed that the instant when the Priority Timer TP is set constraint to synchronization, this is necessarily distinct from the instant when a power packet is assigned, which is different for each user UI as anticipated in transition T.14.

Obviously, the 16-bit instance is generally valid for any number of bits, provided it is capable of representing both a sufficient number of priority values and a sufficient number of user addresses.

A fourth procedure to hinder the system from oscillations consists in avoiding that two or more users UI may have the same Dynamic Priority PRD value for an undefined number of subsequent competition States; this may happen in different ways, each one of them not excluding the other.

First of all the highest value achievable by Dynamic Priority PRD can be limited for those

users whose service is surely a minor one in certain hours, so as to favour e.g. an electric oven with respect to any other user.

According to a more general solution, Dynamic Priority PRD curves may all have a different slope as a function of time. as the ones shown in figure 9 associated with each user UI, at least for those activity steps of the smart users UI requiring a relevant power absorption, where "considerable absorptions" mean those values determined by the experience. Thus, if for instance in a determined instant two "considerable absorption" users with equal Dynamic Priority PD performing a transition T.4 together are brought in Competition State, this cannot occur in a subsequent instant, as in the meanwhile there will have been a divergence between their respective Dynamic Priority PRD values.

In the frame of the method for managing electric power consumption of a users system according to the present invention, the programming knob for starting operation of a household appliance reflects a new meaning.

Presently the consumer is able to set start time through said knob; moreover, some projects at European level provide a user setting for lower consumption and operation during lower electricity rate timetables All these approaches are intricate and uncomfortable for the consumer.

Instead of setting start time, the consumer can set the program end time, which is a closer approach to the consumer's real requirements allowing operation optimization for the users. In fact, if before the program comes to end lower power rate hours are available, the user will automatically wait till that before start operating; if, on the contrary, program end is foreseen before the lower power rate hours start, the users will simply wait for Available Power PD, while Dynamic Power PRD increases more and more in approaching activation time for the users so as to terminate the service in time. Thus, users choose autonomously their optimisation principle utilizing, if possible, lower power consumption timetables though adapting themselves to the consumer's needs.

Moreover, a laundry wash-machine may for instance activate the last water discharge and spin cycle short before the time the laundry should be ready (limiting a creasing of the

clothes).

In the instance of a refrigerator, it is important for it to learn how to operate according to the consumer's habits. Practically, it has to accumulate cold before a more frequent door opening or greater introduction of food at room temperature occurs. Door openings are detected directly by the microprocessor, while food introduction (thermal load) can be detected by a temperature increase in the freezer compartment. Moreover, a refrigerator can perform defrosting at night time; night defrosting is more appropriate since a temperature increase following a defrosting operation will be less annoying; such a procedure can be favoured reducing refrigerator's Dynamic Priority during day time and increasing it during the night. Such a procedure is correct, since it will make day-time defrosting less appropriate but not impossible; however, if during day time power is largely available for limiting a defrosting, it will be necessary to reduce the power usable by the refrigerator artificially. As it can be seen, a Dynamic Priority function PRD can also be used to force some users towards preferred behaviours also apart from possible conflicts for the procurement of Available Power PD, i.e. Dynamic Priority PRD generally becomes a guide for a reasonable behaviour of the users wherein it is located.

The electric meter CE or measuring node NM can also send further information on environmental conditions, which cannot be detected from individual users, such as the energetic rate in force, day time, date or other useful information common for all users; in fact, also the contract power rate and not only the rate may be variable with timetables, such as higher during night time and/or Summer; the electric meter CE should be able to know it in real time or from a communication of the Distribution Board or consulting a stored table associated to a clock and/or a calendar.

Overload Indication

As said above, the users system U is able to comply with an overload, i.e. it prevents the magneto-thermal switch from operating, it performs optimal distribution of Available Power PD, moreover each user UI is ready to start again as soon as its required power becomes available. However, some users UI have anyway to limit their consumption for a

certain time and are not favoured by it. Therefore, it is appropriate to provide means advising the consumer about the situation. The system is able to signal the situation to the consumer if one or more users are equipped with a sound and/or luminescent signal (LED or display), to be activated under overload condition, i.e. PD < K2 or PD < K3. Alternatively, the signal may be given by the users entering a QUIESCENT State or by the users that have already spent a long time in Wait state. 2 or 3 different signals may be given according to the seriousness of the situation. By way of an orientative non limiting example:

1st signal: PD<K2

2nd signal: PD<K3

3rd signal: Users have been in Wait State for 1 hour.

Thus, the consumer can be made attentive to consumption problems and it is also possible to work on human factor to improve managing household consumptions.

Faults to the communication system from Measuring Node NM to users systems.

If no signals are received from the Measuring Node NM due to any faults or interferences, the users receiving no messages can take a maximum value for Available Power PD. Thus, the system performance is in no way worse to that of a conventional users set, also in the case of a likely faulty component.

According to the above description the features of the present invention are clear, and also its advantages are clear.

In fact, the method for managing electric power consumption of a users system according to the present invention will prevent exceeding a predetermined electric power threshold globally absorbed by smart users, which adjust their consumption based on their own rules and internal information, other than on periodic information supplied by the Measuring Node.

Such rules are such to advantageously exclude to have the contract power limit exceeded by a considerable value for an extremely long time, whereas if the users request it, all the available power can be substantially used and shared in an optimal way according to

priority principles.

However, advantageously, activation of a low priority household appliance is not delayed for an unlimited time and a low-priority users system can be activated if its power request is not engaged at that time.

Such a system is stable: once a users system has acquired power it can terminate its current task within a reasonable time interval, without jeopardizing its performance nor increasing its global consumption and excluding any oscillation due to equal priority users systems.

Moreover, the system is advantageously a robust system, in the sense that in the worst operating conditions (such as noisy transmission means, defective component) the users not affected by improper use are not inhibited and operate at least like a traditional system without behaviour rules.

Installation can be a so-called plug-and-play type, i.e. it does not require control system configurations of the users and of the measuring node. Additionally, the system is open and control algorithms are in fact independent from the number of smart users connected; each user can be installed and/or removed without re-programming the Measuring Node NM or any other users.

Smart users are compatible with conventional "dummy" users (such as an iron) or other smart users that may be developed later.

The method described is extremely flexible for subsequent general behaviour amendments, simply changing the criteria used to process the Available Power PD function and/or threshold power values K0, K1, K2, K3 and K4.

The behaviour of each user is flexible and it changes according to the program in course (e.g. cotton or woollens washing), program step (e.g. heating start, heating end) and program reconfiguration for terminating it with a lower power or energy consumption.

Moreover, access to power can be favoured during lower rate periods.

Users behaviour is conditioned by simple rules, which do not require a complex programming, though not hindering complex behaviours of the users themselves, exclusively determined by the Dynamic Priority function, whose specific calculation

procedures for each user type outline its nature.

Behaviour sophistication of individual users can be refined in time for subsequent users generations, without entailing any complications or even implying logic process reprogramming of control systems SC or of the Measuring Node NM.

As a result of such a flexibility, the system users may get to learn a consumer's habits to obtain customized management of consumptions, without any unpredictable undesired global behaviours occurring due to ensuing behaviour modifications.

It is obvious that many changes are possible for the man skilled in the art to the method for managing electric power consumption of a users system described above by way of example, without departing from the novelty spirit of the innovative idea, and it is also clear that in practical actuation of the invention the components may often differ in form and size from the ones described and be replaced with technical equivalent elements.

Modifications to the behaviour diagrams and valid transitions for control systems SC of all smart users UI are also possible, in other words it is assumed for each smart user UI to have the same behaviour, apart from its functional features. On the other hand, modifications to the state transitions are possible in the frame of the present invention, which have a restricted application for some particular smart users.

For instance, a QUIESCENT State is appropriate for warranting the system stability, but it can be eliminated in some instances or for some users. A refrigerator generally has a very low consumption (about 200 W) though it may absorb 10-12 Amp in less than one second. Since this consumption has an extremely short duration in time, its activation during a thermalization step of the oven or any temporary window with the required power available would not cause any problem. An analogous situation occurs for a laundry wash-machine or dishwasher requiring power for a very short time, about one minute as just required to bring temperature from 27°C to 40°C. In these cases the QUIESCENT State can be avoided and a user loosing in a competition stage will go directly over to wait state.

By way of a further example, a laundry wash-machine may have a very low Dynamic Priority when starting operation, if there is an overload, it may probably happen that the

washing machine is unable to start heating and remains at standstill with the laundry and soapy water in the tub. Such a situation, if extended in time, may increase clothes wear; therefore, it would be appropriate for the washing machine to verify if Available Power PD is sufficient to activate the heater before taking water in. In the negative, it will go directly to the Wait state without going through competition.

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CLAIMS

1. A method for managing electric power consumption of a users system, said users system comprising:
   - a set of users (U), comprising in turn a set of smart users (UI) equipped with control systems (SC), said set of users (U) being operatively connected to a power supply network (RE);
   - power measuring means (CE, NM), capable of transmitting information on power consumption (PD) to said control systems (SC);

   where to each smart user (UI) is associated a priority value (PRD, PriorEff) that defines its right to access power under the control of the control systems (SC) jointly with the information on power consumption (PD) transmitted by the power measuring means (CE, NM)

   characterized in that

   said priority value (PRD, PriorEff) is calculated by the control system (SC) in function of the state of the associated smart user (UI),

   the control system(SC) uses said priority value (PRD, PriorEff) to decide the right to access for the associated smart user (UI) to the power consumption (PD) available from the power supply network (RE).

2. A method for managing electric power consumption of a users systems according to claim 1, characterized in that that said priority value (PRD, PriorEff) is obtained at least by evaluating a dynamic priority (PRD), that is function of the state of the associated smart user (UI), using said dynamic priority (PRD) as starting value allocated to each respective smart user (UI) to calculate an effective priority (PriorEff) that the associated smart user (UI) uses as a counter in a competition procedure (S.2, S.6, S.7) within the set of smart users (UI) for accessing the available power packets before the other smart users (UI).

3. A method for managing electric power consumption of a users systems according to claim 2, characterized in that said priority (PriorEff) evolves in time as a function of

dynamic priority (PRD).

4. A method for managing electric power consumption of a users systems according to claim 3, characterized in that a power consumption (Pot[i]) required by the smart user (UI) is subdivided in power packets (ΔP) and in that the control system(SC) uses said priority value (PRD, PriorEff) to decide the right to access for the associated smart user (UI) to the consumption of power packets (ΔP) that are part of the power consumption (PD) available from the power supply network (RE).
5. A method for managing electric power consumption of a users systems according to claim 4, characterized in that said effective priority (PriorEff) is employed for initializing time counting means (TP), which cause the value of said priority (PriorEff) to evolve for performing said competition procedure (S.2, S.6. S.7).
6. A method for managing electric power consumption of a users systems according to claim 5, characterized in that the competition procedure (S.2, S.6. S.7) comprises a set of logic states and in that, in line with determined values taken by the information on Power Consumption (PD), the system control (SC) goes over to a Competition for Increment State (S.2, S.6), , reducing energy consumption at the same time.
7. A method for managing electric power consumption of a users systems according to claim 6, characterized in that in said Competition for Increment State (S.2, S.6), the control system (SC) evaluates Power Consumption (PD) information at the end of Priority evolution (PriorEff) dictated by the time counting means (TP) to establish subsequent transitions (T.2, T.3, T.4, T.16, T.20. T.21. T.22, T.23) among the states.
8. A method for managing electric power consumption of a users systems according to claim 7, characterized in that said subsequent transitions (T.2, T.3, T.4, T.16, T.20. T.21, T.22, T.23) are also established based on power threshold values (K0, K1, K2, K3, K4, K5) stored in the control system (SC).
9. A method for managing electric power consumption of a users systems according to claim 8, characterized in that said power threshold values ((K0, K1, K2, K3, K4, K5) are adjustable.

10. A method for managing electric power consumption of a users systems according to claim 9, characterized in that said power threshold values (K0, K1, K2, K3, K4, K5) can be adjusted individually for each smart user (UI).

11. A method for managing electric power consumption of a users systems according to claim 7, characterized in that subsequent transitions comprise taking (T.2, T.22) a packet of available power (ΔP) from the supply network (RE).

12. A method for managing electric power consumption of a users systems according to claim 7, characterized in that subsequent transitions comprise a transition (T.3) in a QUIESCENT State (S.4)

13. A method for managing electric power consumption of a users systems according to claim 12, characterized in that in said QUIESCENT State (S.4) priority (PriorEff) is reset and subsequently incremented at constant rate.

14. A method for managing electric power consumption of a users systems according to claim 2, characterized in that power consumption of a smart user (UI) is reduced through deactivation.

15. A method for managing electric power consumption of a users systems according to claim 6, characterized in that in line with second determined values taken by the information on power consumption (PD<K2) the control system (SC) goes over to a Competition for Decrement State (S.2), so as to reduce energy consumption.

16. A method for managing electric power consumption of a users systems according to claim 15, characterized in that in said Competition for Decrement state (S.6) time counting means (TP) cause the effective priority (PriorEff) to evolve in an opposite direction to the evolving of the Competition for Decrement State (S.7).

17. A method for managing electric power consumption of a users systems according to claim 15, characterized in that in said Competition for Decrement State (S.6) a user (UI), whose time counting means (TP) reach count end, may choose to execute a transition (T.14) wherein a power packet (ΔP) is released).

18. A method for managing electric power consumption of a users systems according to

claim 5, characterized in that in line with determined information values about available power (PD), the users (UI) having a effective priority (PriorEff) below a fixed threshold are immediately deactivated.

19. A method for managing electric power consumption of a users systems according to claim 5 characterized in that in line with determined information values on Available Power (PD), the users (UI) with a effective priority (PriorEff) below a threshold associated to available power (PD) information are immediately deactivated.

20. A method for managing electric power consumption of a users systems according to claim 2, characterized in that the control system (SC) of each smart user (UI) is allowed to use Reduced Load strategies and/or Reduced Consumption strategies.

21. A method for managing electric power consumption of a users systems according to one of the previous claims, characterized in that each smart user (UI) takes dynamic priority values (PRD) differing from the values of each other smart user (UI) to hinder the set of users (UI) from entering oscillation situations.

22. A method for managing electric power consumption of a users systems according to one of the previous claims, characterized in that each smart user (UI) draws a power packet (ΔP) in a different instant to hinder the set of users from entering oscillation situations.

23. A method for managing electric power consumption of a users systems, where each user has an associated priority (PriorEff) for access to energy consumption, characterized in that said priority (PriorEff) is used to initialise a timer (TP) in a proportional mode to said priority (PriorEff) and let the user (UI), whose relevant timer (TP) will first terminate its own count, have access to energy consumption.

24. A method for managing electric power consumption of a users systems according to the previous claim, characterized in that the Priority Timer (TP) is obtained through a counter employing a higher number of bits than the number of bits employed for defining the priority (PriorEff).

25. A method for managing electric power consumption of a users systems according to

the previous claim, characterized in that it uses the most significant bits (P8 … P1) of the Priority Timer (TP) for representing the priority (PriorEff) and the less significant bits (I3, I2, I1) for a second temporary scansion.

26. A method for managing electric power consumption of a users systems, where each user (UI) is associated to a priority (PriorEff, PRD) for access to energy consumption, characterized in that each smart user (UI) is provided to autonomously define its own Dynamic Priority (PRD) as a function of the operating state of the user (UI) itself and environment information.

27. A method for managing electric power consumption of a users systems according to the previous claim, characterized in that dynamic priority (PRD) is defined as a function of information, such as user service duration and/or program in course and/or a program step and/or remaining time to end the step and/or possible program reconfiguration to request less power and/or consumer's habits and/or timetable for service to end and/or electric low-rate timetables.

28. A method for managing electric power consumption of a users systems according to claim 26 or 27, characterized in that Dynamic Priority (PRD) is determined through elaboration circuits operating according to fuzzy logic principles.

29. A users' system comprising a set of users (U), which comprises in turn a set of smart users (UI), with control systems (SC), said set of users (U) being operatively connected to an energy supply network (RE) and comprising, moreover, energy measuring means (CE, NM) apt to transmit information on energy consumption (PD) to said control systems (SC), where said control means (SC) perform autonomously energy consumption control of the associated smart user (UI) based on the information on energy consumption (PD) transmitted by the energy measuring means (CE, NM), characterized in that said control system (SC) comprises means (TB6, TB7, TB8) for calculating a priority value (PRD) in function of the state of the associated smart user (UI)

30. A users system according to claim 29, characterized in that the control system (SC)

comprises time counting means (TP) for performing a count based on the priority value (PRD).

31. A users system according to the previous claim, characterized in that the control system (SC) comprises logic fuzzy elaboration circuits for determining the dynamic priority (PRD) value.

32. A users system according to the previous claim 27, characterized in that said control system (SC) is associated to sound and/or visual displaying means to signal information on energy consumption (PD).

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Fig. 1

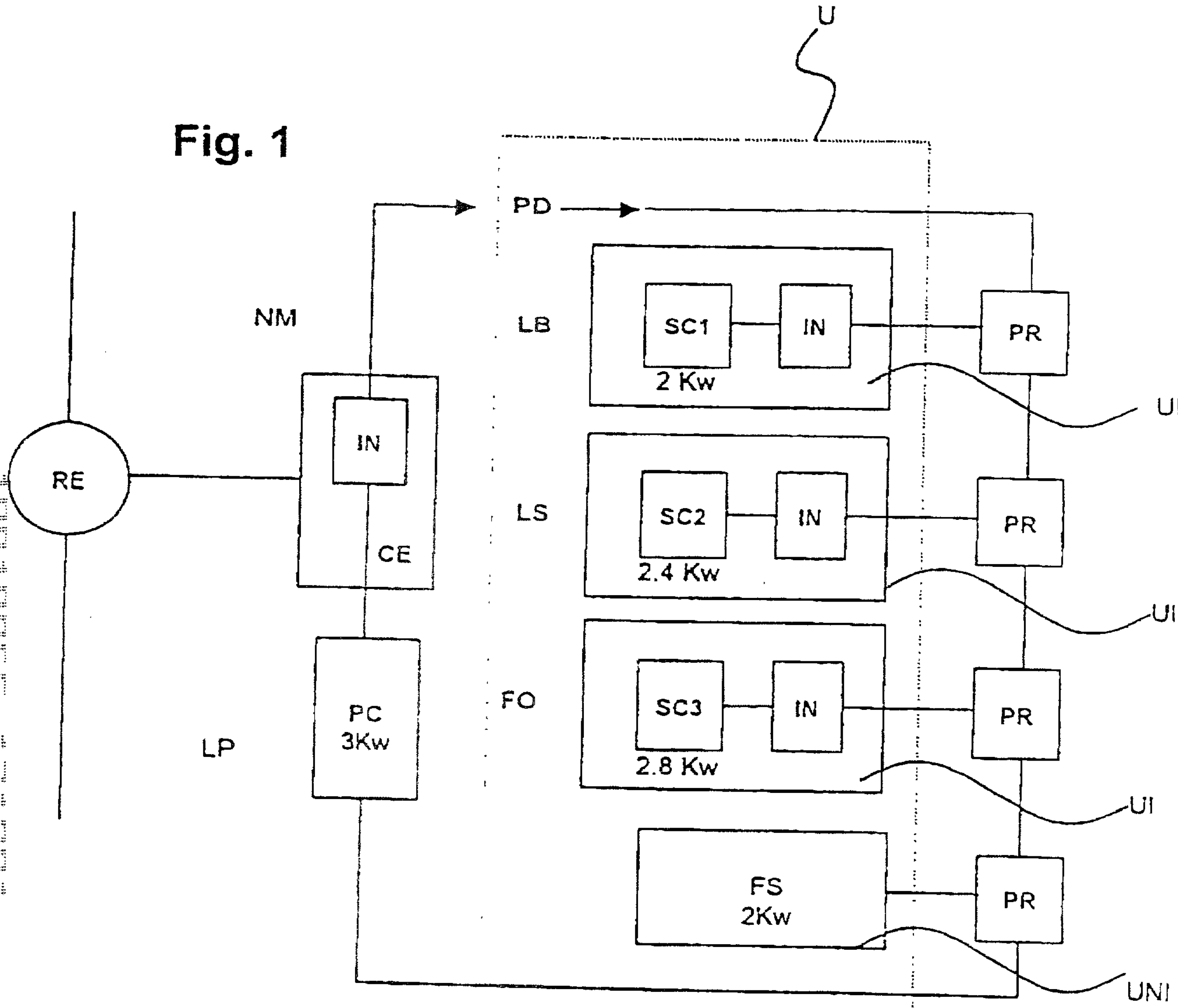
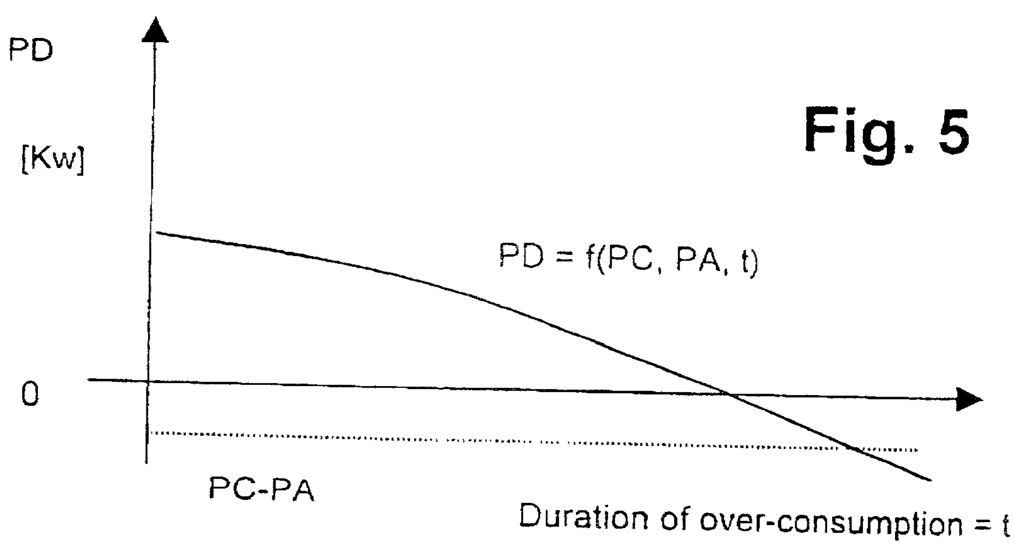


Fig. 5



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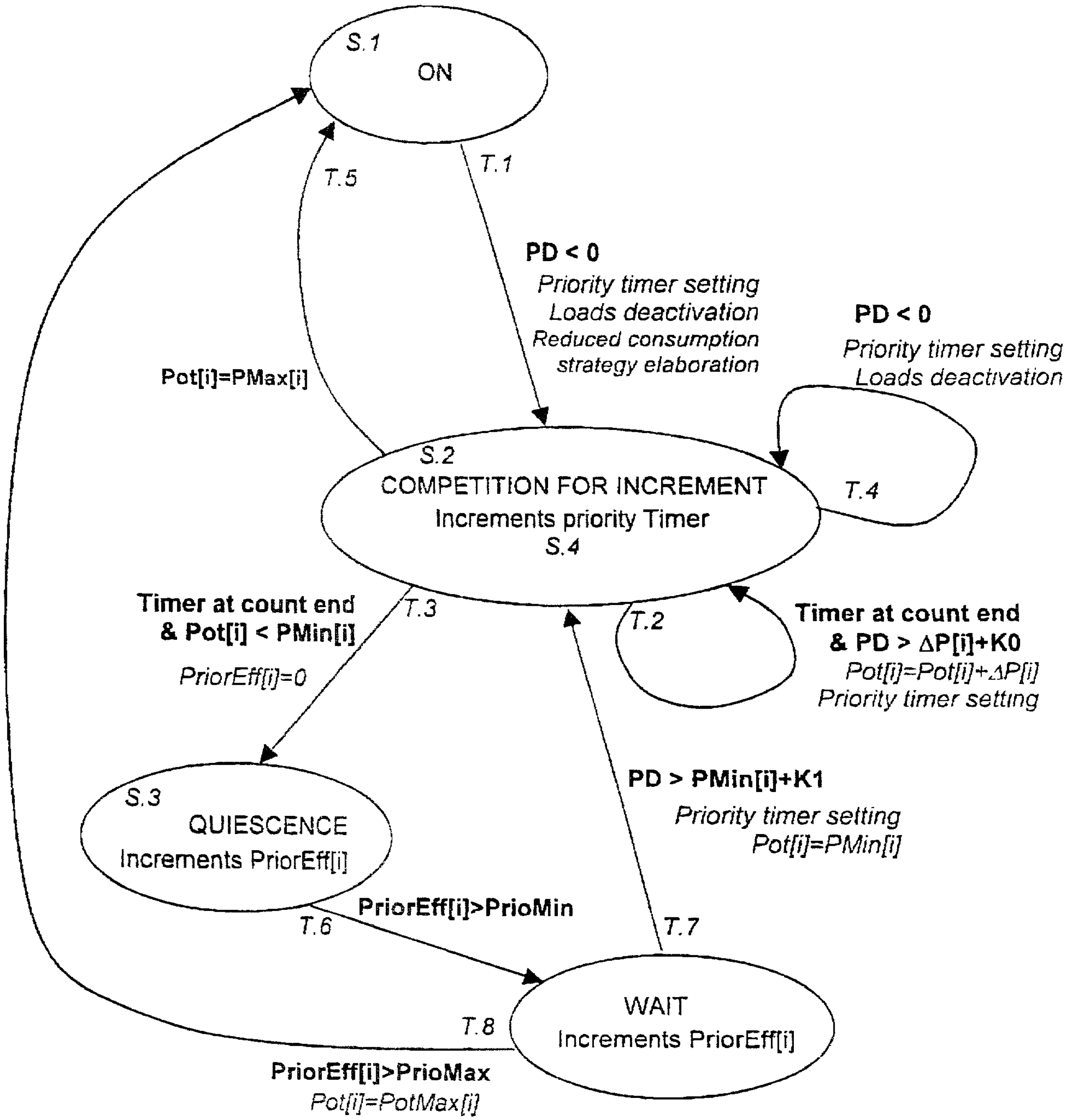

Fig. 2

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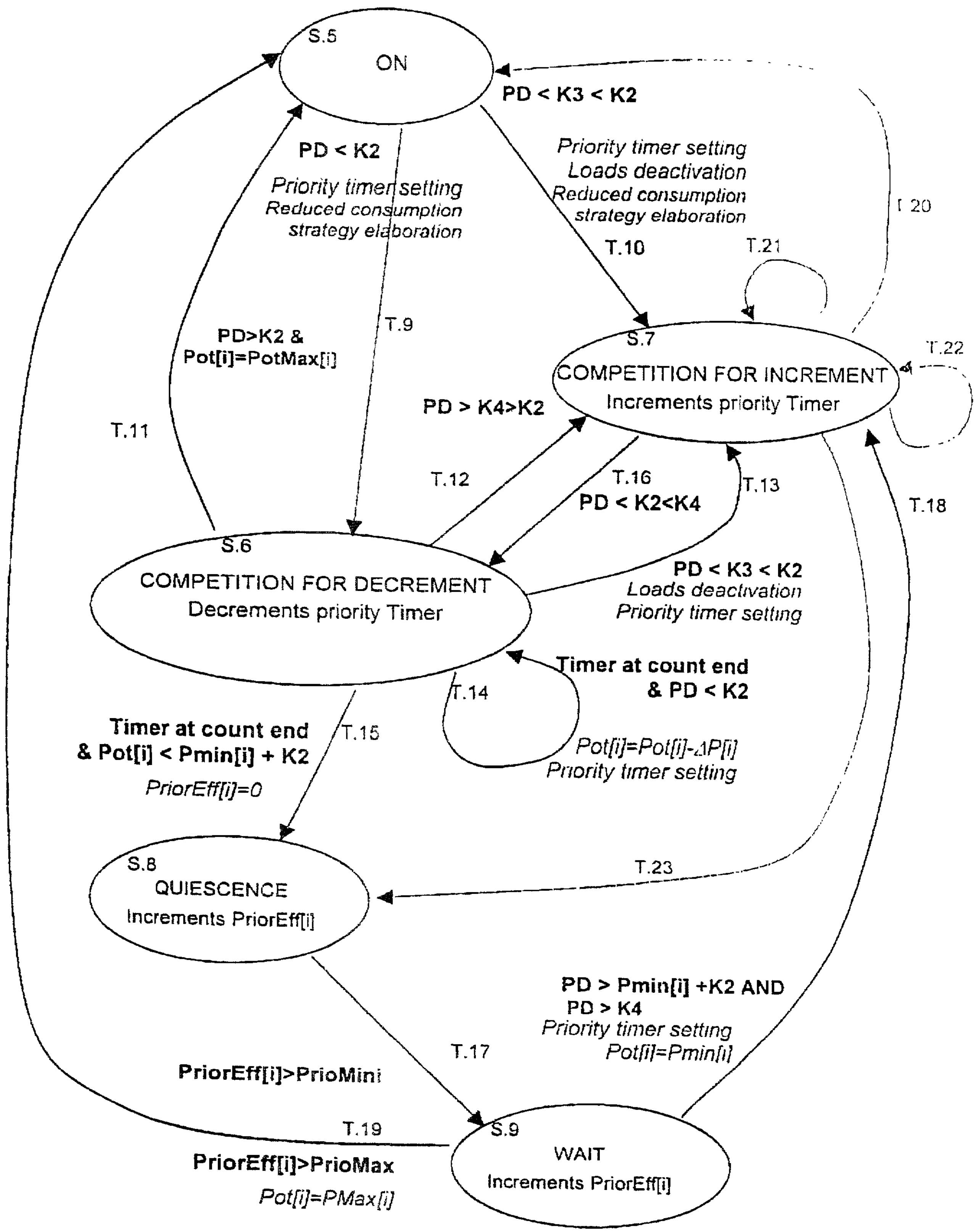
Fig. 3



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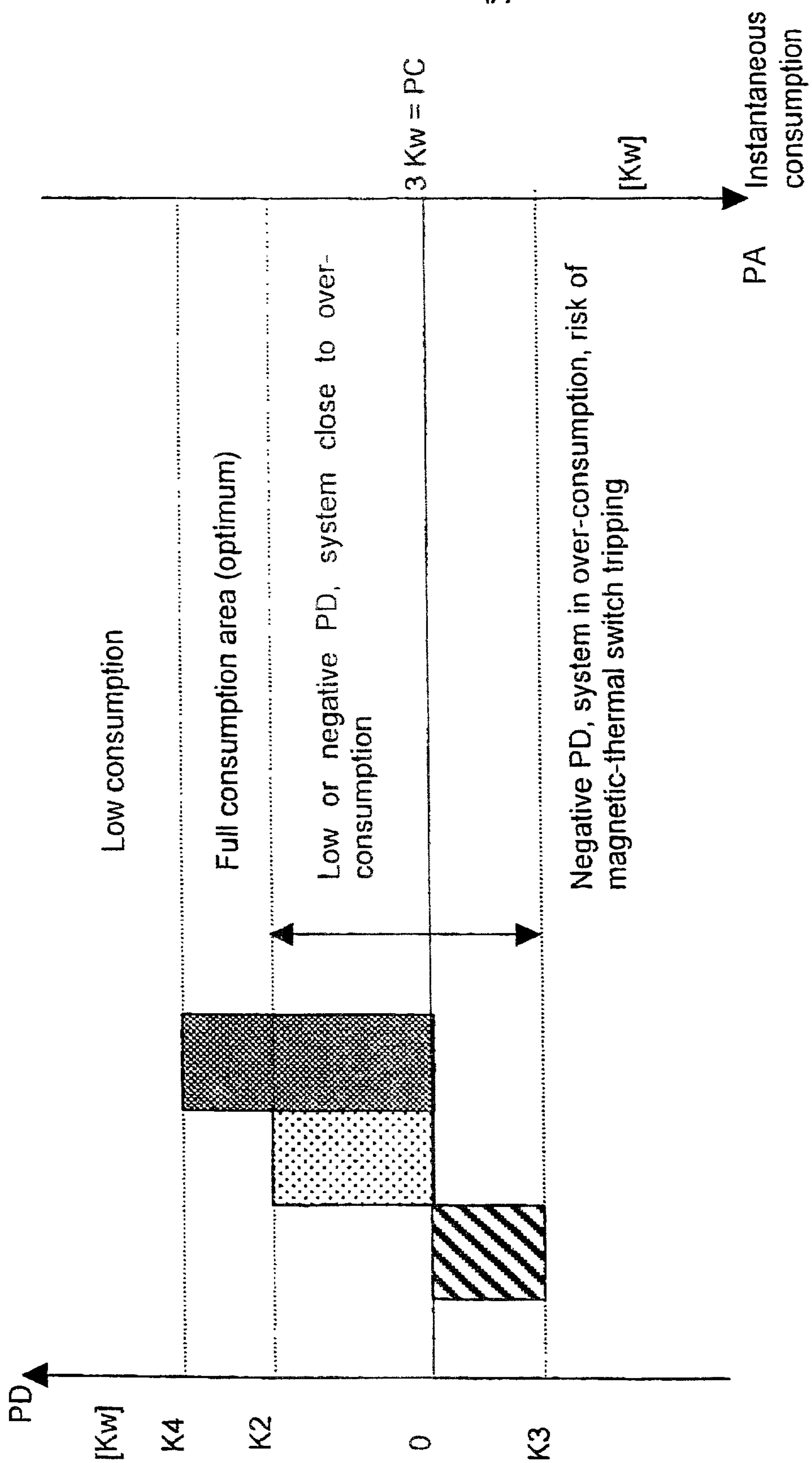

Fig. 4

TB6

Dynamic priority PRD: functions of output	PRD Low	PRD Medium	PRD High
Laundry washer	40	70	105
Oven	60	100	120
Refrigerator	20	65	125

Fig. 6

TB7

If the ***programme*** *is woolen and the* ***time still due to the end of heating*** *is short, then medium priority*

If the ***programme*** *is cotton and the* ***time still due to the end of heating*** *is short, then low priority*

Fig. 7

TB8

Dynamic priority PRD: functions of output	PRD Low	PRD Medium	PRD High
Cotton	40	70	100
Synthetics	40	80	110
Woolen	80	100	120

Fig. 8

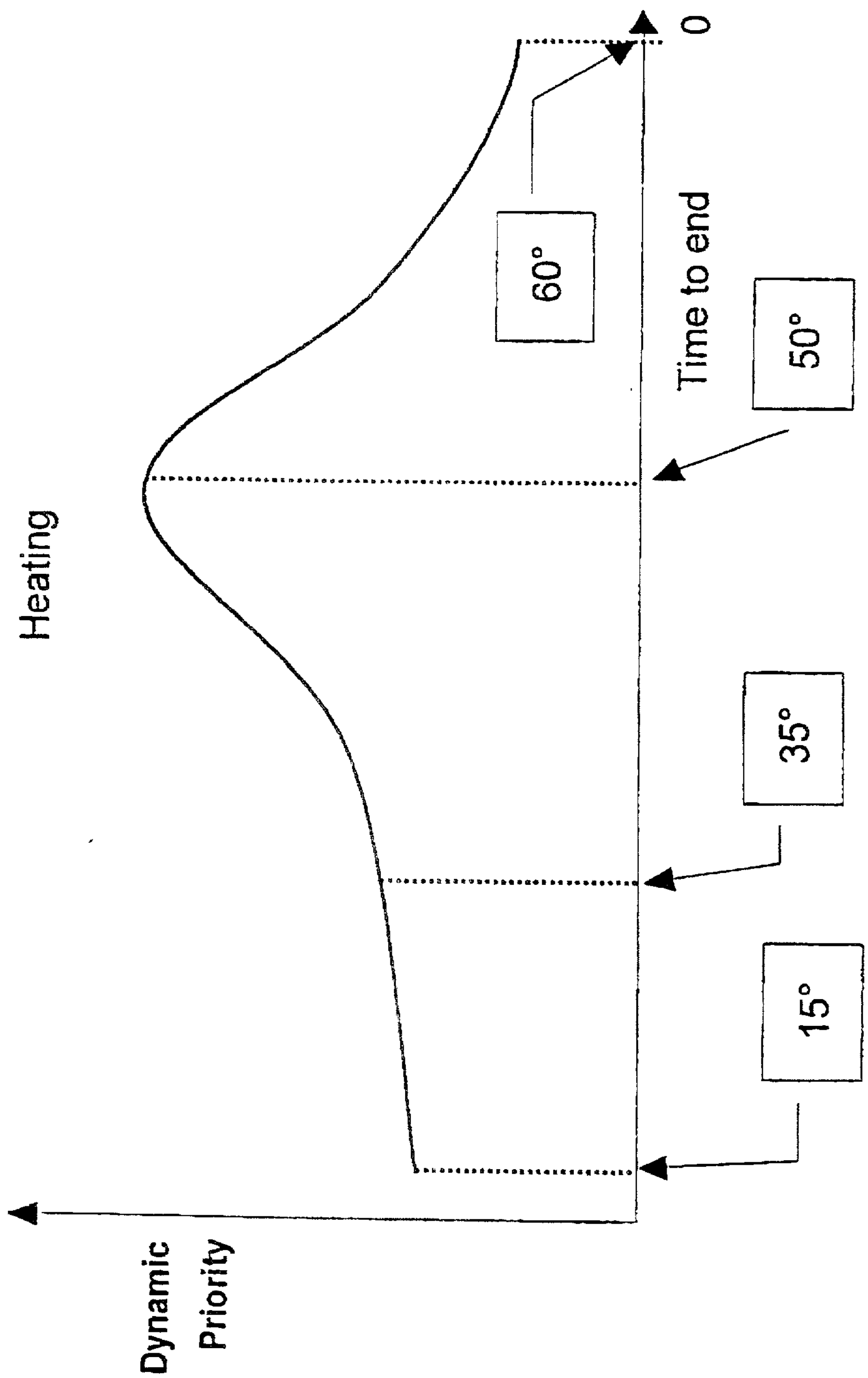

Fig. 9

TP

P8	P7	P6	P5	P4	P3	P2	P1	0	0	0	0	0	0	0	0
Priority bit								Address bit							

Fig. 10

TP

1	1	1	1	1	1	1	1	I3	I2	I1	1	1	1	1	1
Priority bit								Address bit							

Fig. 11

TP

P8'	P7'	P6'	P5'	P4'	P3'	P2'	P1'	0	0	0	0	0	0	0	0
Priority bit								Address bit							

Fig. 12

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below-named inventor, I hereby declare that:

My residence, post-office address, and citizenship are as stated below next to my name.

I believe I am the original, first, and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled METHOD FOR MANAGING ENERGY CONSUMPTION OF HOUSEHOLD APPLIANCES, described and claimed in PCT International Application No. PCT/IB00/00097, which international application was filed on February 1, 2000, designating the United States.

I hereby state that I have reviewed and understand the contents of the above-identified application specification, including the claims, as amended by any amendment specifically referred to herein.

I acknowledge the duty to disclose all information known to me that is material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code §119(a)-(d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate filed by me on the same subject matter having a filing date before that of the application on which priority is claimed: None.

I hereby claim the benefit under Title 35, United States Code §119(e) of the following U.S. provisional application: None.

I hereby claim the benefit under Title 35, United States Code §120, of the United States Application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United State Code, §112, I acknowledge the duty to disclose all information that is material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56, and which became available to me between the filing date of the prior application and the national or PCT international filing date of this application: None.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint Michael E. Attaya, Reg. No. 31,731; Charles J. Barbas, Reg. No. 32,959; Joseph H. Born, Reg. No. 28,283; John L. Capone, Reg. No. 41,656; Robert A. Cesari, Reg. No. 18,381; Yong S. Choi, Reg. No. 43,324; Brian C. Dauphin, Reg. No. 40,983; Steven J. Frank, Reg. No. 33,497; Christopher K. Gagne, Reg. No. 36,142; A. Sidney Johnston, Reg. No. 29,548; William A. Loginov, Reg. No. 34,863; John F. McKenna, Reg. No. 20,912; Rama B. Nath, Reg. No. 27,072; Martin J. O'Donnell, Reg. No. 24,204; Thomas C. O'Konski, Reg. No. 26,320; Edwin H. Paul, Reg. No. 31,405; Michael R. Reinemann, Reg. No. 38,280; Rita M. Rooney, Reg. No. 30,585; Heather B. Shapiro, Reg. No. 41,305; Patricia A. Sheehan, Reg. No. 32,301; and Joseph Stecewycz, Reg. No. 34,442, Cesari and McKenna, LLP, 30 Rowes Wharf, Boston, Mass. 02110, jointly, and each of them severally, my attorneys and attorney, with full power of substitution, delegation and revocation, to prosecute this application, to make alterations and amendments therein, to receive the patent and to transact all business in the Patent and Trademark Office connected therewith. Please direct all telephone calls to Patricia A. Sheehan at (617) 951-2500. Please address all correspondence to Patricia A. Sheehan.

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